Communicating and Collaborating for the Right Lab Test and Diagnosis

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[Dr. Laposata] How we met. I was the clinical lab director at the Massachusetts General hospital in Boston when it was apparent we needed people outside the department to provide advice on our effectiveness. We formed the Clinical Laboratory Advisory Committee, which we called the CLAC, and multiple people in the department of medicine said I should find you to become a member of the committee.

[Dr. Meisel] Mike, when we met I was a busy primary care internist at Mass General. Since then, I've been at Boston University Medical Center being an internal medicine hospitalist, ward attending, and medical student course director.

[Dr. Laposata] So, Jim, as you recall, I had just moved to Vanderbilt and the CDC asked me to co-lead what ultimately became the Clinical Laboratory Integration into Healthcare Collaborative, which we called the CLIHC™. The strategy for this committee was to bring laboratory experts together into the same group, with physicians, to identify problems in the laboratory and propose solutions. So, remembering what a good job you did on the CLAC, I was pleased when you accepted the appointment to CLIHC™.

[Dr. Meisel] Mike, in my real world practice, I've actually got some problems with the clinical laboratory. Am I safe telling you this here? Well, you know, this might actually be the ideal place to tell you about some of the challenges I've run into. So there are three, actually. The first one has to do with clinical laboratory test selection. The second, interpretation of those test results. And third is my knowledge base with regard to lab medicine. But you know something? That actually might cut both ways. Do you really know what my needs are as a generalist physician? So let me give you an example. This is an example of the first problem that I mentioned, test selection. So I have a 26-year-old patient, a woman on oral contraceptives who presents with swelling of her left leg. It's painful, and she's also complaining of shortness of breath. With national guidelines and some help from my radiology colleagues, I know exactly what to do next. I order a lower extremity ultrasound, which shows a deep vein thrombosis, which I think has led to a pulmonary embolism. But I'll also say that if I had any questions about whether or not I was ordering the right imaging study.

Dr. Laposata] So, do you mean, like, whether you should have started with a CT pulmonary angiogram?

[Dr. Meisel] Yeah, exactly. So if I wasn't sure exactly which was the correct test to order, there would almost always be an expert radiologist available to help me out. Radiologists are also proactive about helping me make sure I order the right test to answer the right clinical question. And, you know, this is true even in a small hospital. This service is pretty reassuring for me, knowing I'm doing the right thing for my patient at the right time. So, all right, let's go back. I want to evaluate this woman for hypercoagulability. See, here's my first problem—I really can't tell from this test menu what is the right test to order. You've given me a long list of available

tests that are associated with coagulation. How do I determine exactly which is the right test to order without leaving out any that are important or adding in any useless ones? And I've got to draw this blood before she's on any sort of anticoagulation. How do I figure out if that's true? And I need to know now, because getting her on treatment is emergent. Could the coagulation laboratory give me some of those answers?

[Dr. Laposata] Well, I'd bet almost every experienced coagulation laboratorian could answer that question for you, Jim. Get the patient moving in the right direction right away. In about 1980, the test menu for hypercoagulability was three tests—Protein C, Protein S, and antithrombin. Then we realized that so-called lupus anticoagulants increased the risk for thrombosis, and there were several different lupus anticoagulant tests available. They were grouped into screening and confirmatory tests. By about 1990, we realized that anticardiolipin antibody tests involved detection of the same antigen that's detected in the lupus anticoagulant tests, and that needed to be added to the panel, too, so this added IgG, IgM, and IgA anticardiolipin antibody tests to the menu of assays used to assess the patient for hypercoagulability. And then in the 1990s, the factor V Leiden and the prothrombin 20210 mutations were discovered and found to be amazingly common among Caucasians, and there's more coming in. So that's where we stand.

[Dr. Meisel] You know, for general internists like me, frankly, there's no way I can learn the thousands of tests that have been added to the test menu in the last five to ten years. Mike, even specialists in a field outside their own are unlikely to know all the rest of the tests. I mean, for example, I doubt that my endocrinology colleagues would know what coagulation tests to order, either.

[Dr. Laposata] True.

Dr. Meisel] So, this is an important issue. We both understand that not ordering the right test could cost a patient his or her life, just like taking out the wrong kidney or ordering the wrong drug. Is there anything you can do to help us select the right tests for these patients?

[Dr. Laposata] So, yes.

[Dr. Meisel] Well, we aren't even going to become experts and find a way?

[Dr. Laposata] Yes, yes, and yes.

[Dr. Meisel] Okay.

[Dr. Laposata] So, we could organize reflex test algorithms that would allow you to just check a box requiring an evaluation for hypercoagulability. And as another example, we could probably do the same for the prolonged PTT. It sure would be a lot easier if you could just check a box that said "evaluate the patient with a prolonged PTT," and then you wouldn't have to worry about which particular factor deficiencies prolonged the PTT and not the PT. So this may be the answer to your complaint about patients getting upset at having to miss work to get their blood redrawn. Although our audience may be familiar with this, let me tell you that a reflex test algorithm is not a panel of tests. The algorithm is done one test at a time and then the results of the most recent test tell you which test you should do next, until all the right tests–with no extra tests–are performed using the single sample you submitted to us. We would not ask you to keep

re-evaluating the patient, drawing blood at each visit, and then weeks later receiving the diagnosis.

[Dr. Meisel] You're right. That's terrific, because that's how most of us were taught to think, you know, to use step-wise testing as we work towards the diagnosis. But what happens is as we start our practices we are seeing 20 patients a day and suddenly we do start sending panels of laboratory tests—kind of a shotgun approach—thinking that even if we don't have time to aim precisely we'll probably hit a target most of the time. So, for example, when a PTT is elevated we sometimes order every test we can think of that might explain the prolongation. So I like the concept of reflex testing, you know, where you perform tests sequentially, without a separate order from me for every test in the series. You know, in the lab report, could you actually describe what you did down there so I could actually learn along the way?

[Dr. Laposata] So we could run through the tests in the algorithm using the single sample, and then we can even interpret the final results for you so you can confidently move forward with treatment. And sure, the report could have an educational component. How does that sound?

[Dr. Meisel] I like it. Hey, didn't you have a list of about a hundred algorithms covering different conditions when you were at Mass General?

[Dr. Laposata] We did, Jim. Specialists in coagulation are creating algorithms for the entire field. The goal is to make it possible for you to convincingly establish a diagnosis of, say, factor XII deficiency if it's present, even if you don't know what it is. It's not a small job; we anticipate the need to create, say, more than 50 algorithms for coagulation alone to get it done. And although it's a challenge, a group of us has already begun to try to meet it. Okay. Let's talk about your patient now with the deep vein thrombosis. We did all the tests for hypercoagulability. We used a reflex test algorithm—everything was absolutely normal, except for one thing, and that was a low value for protein S activity. Now, I might add that the total protein S antigen test was within reference range and that the pre-protein S antigen approximated the protein S activity.

[Dr. Meisel] Was that a foreign language you just broke into? No, really—I have no idea what the significance is between a free protein S antigen and the total protein S antigen. How do I use that information to determine if this low protein S activity represents a hypercoagulable state for my patient or not? Because I just want to know one thing. Do these findings indicate that my patient has a genetic predisposition to thrombosis because of protein S deficiency? That's it. Is she going to need warfarin for the rest of her life? Because that will be very problematic if that's true. You know, she loves kayaking and rock climbing, and she would need to change her lifestyle. She'll bleed much more with her menstrual periods. She might become anemic. And she might have to use a different anticoagulant when she gets pregnant because warfarin could cause birth defects. You know, she'll forever be at increased risk of major bleeding episodes, so basically what I'm saying is there are huge implications for her to get this diagnosis right. And I guess this is an example of my second problem with the clinical laboratory. We don't always know how to interpret the results when we get them.

[Dr. Laposata] So, I'll explain, Jim. As you obviously know, protein S, when it is congenitally deficient, does represent a thrombotic risk. However, protein S goes down in pregnancy with the presence of estrogen supplementation, as in birth control pills and in post-menopausal estrogen therapy, and in the acute phase response as when you have surgery or injury or infection. In these

situations, the low protein S is transient – it's not a risk for thrombosis. So before you make any conclusions about whether she has an inherited protein S deficiency and is predisposed to thrombosis on that basis, you better know whether she's pregnant, taking the pill, or experiencing an acute phase reaction.

[Dr. Meisel] Like your pregnant patient or like your patient? You know, I wish that kind of information could come back to me with the test result itself because I didn't know any of that. You know, I didn't even know that I didn't know that.

[Dr. Laposata] Well, you're not alone. As you know, a survey conducted by our CLIHC™ committee at the CDC. Your conclusion is supported by preliminary data from this extensive survey of nearly 2,000 primary care doctors.

[Dr. Meisel] You know, the opportunity is much broader than coagulation. Let me think—there are algorithms that could be really useful for, um, thyroid function testing, workup of anemias, hypercalcemia, low testosterone, antinuclear antibodies—these are conditions that everybody presumes we treat efficiently, but I bet we could do an even better job. The bottom line is we need these diagnostic tests to help us get to a final diagnosis, and we need to do it as fast as possible with the most accuracy, and I would add, actually, for the best value.

[Dr. Laposata] So, we have two problems up to now. One is how tough it is to pick the right test, and the second one is how hard it is to interpret them. So it's clear to me now, and hopefully everyone in the audience, that as the test menu got bigger, it became impossible for intelligent and dedicated clinicians like you to know which test to pick, and importantly, to know what the test results mean. So the way the status quo is now, there is no system or person to help you, Jim, unless you independently find someone in the laboratory who is willing and able to do it. You make your best guess. The surprising part is that most physician leaders in medicine today don't realize the severity of the problem. Healthcare reform mavens are talking about ordering too many tests—not how impossible it is for doctors to pick the right test every time to get the diagnosis quickly and accurately. Do you think that patients know well-trained intelligent doctors have such a problem using lab tests to establish a diagnosis?

[Dr. Meisel] Again, I doubt that many docs know what they don't know about lab medicine, or say anything about this to their patients. I would say that most patients aren't even aware of the dilemma about which test to pick and the meaning of test results in which we find ourselves. For that example you described a few moments ago, I bet there are a whole lot of women out there who think that they have protein S deficiency and are predisposed to clotting because they were tested for protein S when they were taking birth control pills or pregnant, whose doctors thought they had done a good job interpreting a low protein S value.

[Dr. Laposata] Ah. Jim, I know of a woman who was tested during pregnancy—during pregnancy—for protein S, and it was low, as it is in every single pregnancy, and not a thrombotic risk factor in that setting. And you know what the obstetrician did? He told her that if she did not terminate this pregnancy, that she desperately wanted to keep, she had a high risk of dying from a blood clot during the pregnancy. So she reluctantly decided to terminate, and I had to tell her three months after the termination when she came to see me as a patient in my office practice that her diagnosis of protein S deficiency was a mistake.

[Dr. Meisel] Wow.

[Dr. Laposata] Outside of pregnancy, her protein S was absolutely normal. So that's a powerful example why a misdiagnosis can have severe consequences for a patient. So on to the next topic. By the way, you went to a good medical school—how much training did you and your classmates receive about coagulation? How about teaching specifically about lab tests required to establish diagnoses associated with bleeding or thrombosis?

[Dr. Meisel] I bet it was about the same as you had. We had two lectures on anticoagulation. One was on platelet life cycles, and the other was on the intrinsic and extrinsic pathways. No one ever really taught us how to diagnose very much using laboratory tests, except some occasional commentary on lab tests when a particular disease was being discussed. And frankly, in those contexts we didn't learn very much about the operating characteristics of the tests themselves. You know, even though we order lab tests every day—and lots of them—the medical school curriculum in many institutions does not adequately teach students which tests to select or how to interpret the test results and that, my friend, is my third problem with laboratory medicine. No one ever really taught us this stuff. At least, not in a way that we can apply it to patient care.

[Dr. Laposata] And you know, Jim, I'll bet you that most doctors don't even know what the operating characteristics of a laboratory test mean.

[Dr. Meisel] Yeah, I bet you're right.

[Dr. Laposata] I have an even better one for you about operating characteristics. The docs in a primary care clinic I know were not aware that the screening test for HIV infection has false positives that need to be confirmed with a more definitive test. They were telling patients that they had an HIV infection after a positive screening test because they didn't know the operating parameters of the HIV ELISA test. Imagine the impact of this on patient safety! They were being given drugs to treat HIV and they did not have it. One of the biggest reasons for changing the medical school curriculum is to better enable doctors in all specialties to do a better job ordering lab tests, interpreting them correctly, and at the same time knowing their limitations. And shouldn't the person who knows the most about the lab tests teach that material to students? I don't give the lecture on how to remove a gall bladder. The non-systematic approach to lab medicine education only made sense when the test menu was tiny, and it has not been that way for the last 30 years.

[Dr. Meisel] (*Chuckle*) Yeah. All right. Let's go beyond the medical students for a second. How about the people that work in the clinical laboratory? Aren't they supposed to be learning about the appropriate test selection and how to interpret the results?

[Dr. Laposata] Well, would you believe that except in a few institutions we really aren't teaching test selection and result interpretation to virtually anyone in the clinical lab well enough to enable them to provide advice. The net result is that, short of subspecialty consultation, like calling the hematologist, there is literally no one in the laboratory systems in most institutions to help you as a general internist or a family doctor. You can add that to your list of roadblocks. Face it, you're forced to make that educated guess about the appropriate diagnostic studies and what they mean when it comes to the clinical lab. One upshot is that doctors are ordering either too few or too many lab tests. Both are big mistakes. Not enough lab tests means it takes longer

to get the diagnosis, and too many laboratory tests means that you're either spending too much money on tests that don't help you, and neither improves diagnostic accuracy. You said earlier, for an answer to a simple PTT elevation that would be straightforward to a lab specialist, like, when there's heparin in the sample, a primary care doc may choose to order mixing studies and coag factors and lupus anticoagulants, just about every test he or she can think of that's related to the PTT.

[Dr. Meisel] Well, you know, I think a lot of us in that scenario don't know, or at least don't remember, what the best tests to select are, and it's a lot less time consuming to send everything. There's not really a disincentive for sending off a whole bunch of lab tests. No one's every approached me telling me I'm ordering too many lab tests.

[Dr. Laposata] Really? Let me follow up on that. So in your world, no one is asking you about ordering unnecessary tests?

[Dr. Meisel] No.

[Dr. Laposata] So now that I think of it, at Vanderbilt doctors ordering tests that cost thousands of dollars are the ones that receive a call from the laboratory director. But you're right. Even at my institution, any doctor ordering unnecessary tests that cost just hundreds of dollars flies under the radar.

[Dr. Meisel] That's right. So it's rare for anyone, including my patients, to challenge me on the cost of the test that I'm sending. I do think the upcoming changes in reimbursement that that's all about to imminently change. Right now I have no idea what the tests cost. You know, I suspect you know what you're paying for reagents and supplies and personnel but I have no idea whether a test costs you seven bucks or seven thousand dollars to perform. I've seen some other institutions put dollar signs next to their lab printouts, which give people a sense of exactly, you know, what…what this test costs and whether it's almost free or ridiculously expensive. But that's not typical. If you'll allow me to just digress for a moment, to get back to the question of value, I do think all of this is about to rapidly change. In 2010, the American College of Physicians, ACP, which is my professional organization, launched the High Value Cost Conscious Care Initiative, HVCCC, to connect two important priorities. One is to help people provide the best possible care to patients, and two, to reduce unnecessary costs to the healthcare system. But Mike, as the name suggests, it's not all just about cost control. Rather, this initiative asks whether a test's net benefit, the extent to which its benefits outweigh its harms, is worth its cost. So this requires knowing test costs, their benefits, and how patients and society value them. So let's talk about another case to raise a different problem I have with the laboratory – how these tests are named.

[Dr. Laposata] Uh oh.

[Dr. Meisel] (*Laugh*) You should uh oh. So listen. So I have another patient – a woman who has…probably has osteoporosis. I really need to get a Vitamin D level. On your test menu, it looks like I can order a Vitamin D, a 25-hydroxy Vitamin D, and a 125-hydroxy Vitamin D. But I assume if I check the box that says Vitamin D it will be good enough to determine if Vitamin D supplementation is necessary. Unfortunately, I also noticed that there seem to be two more tests for each of those Vitamin D options—a Vitamin D2 and a Vitamin D3. I guess that means that

there are Vitamin D2 and Vitamin D3 assays and a 25-hydroxy Vitamin D2 and a 25-hydroxy Vitamin D3, and the same for the 125 ones. That makes at least six additional tests, and I probably just need one test. And then, on my computerized order entry screen, there are all these abbreviations for Vitamin D testing. I'm not sure how to connect these confusing abbreviations with the actual tests. They're taking complicated test names and apparently randomly representing them with only six characters. Even if I did know what test I wanted, I might order the wrong one because I can't tell which abbreviation is for which test.

[Dr. Laposata] Yeah, this is a huge problem, and I apologize for all of us in the entire lab industry. We…we make it complicated for you by calling the same test by a bunch of different names. (*Pause*) (*Laugh*) With the many Vitamin D iso forms and abbreviations. A test you remember by one name in the hospital where you did your residency is the same test, called by a different name, where you're working now. So that is another problem we have to fix—developing technology solutions to reduce the confusion about naming lab tests. Wouldn't it be great if everywhere you practiced the same name was used to describe the same test?

[Dr. Meisel] Yes. (*Chuckle*) Okay. Let me tell you about two last cases illustrating something that happens dozens of times a day in any big hospital—the evaluation of a patient with chest pain. So, these point out all the problems we've been talking about—test selection, confusing names, education, and the ability to get help with interpretation. Mike, nobody ever told me the difference between troponin T and troponin I. The threshold above which I should be worried about myocardial injury has been going down as you introduce more and more sensitive tests in the lab. When my lab recently changed its normal range, several of my inpatients developed positive troponins overnight, and that wasn't because they'd gotten sick. It was because they'd changed the normal range. I actually don't know which test my laboratory is running right now, so how could I tell the threshold above which I should be thinking this patient had an MI? Is this troponin the same one I learned about five years ago?

[Dr. Laposata] Well…um.

[Dr. Meisel] Wait. Wait, wait, wait. So here's the second short case. This last May, I provided a perioperative consultation for a 49-year-old patient who had a submandibular infection that was spreading. She was already on antibiotics; it was still getting worse. We were asked to see her for a complaint of chest pain and a positive troponin. When I talked to the patient, she tearfully and effusively described to me how stressful her life had become, barely mentioning vague chest pain that, frankly, did not sound at all cardiac to me. The EKG was normal. In other words, there was very little in the story that suggested to me that this woman was having an acute coronary syndrome. That is, until we got back their clinical lab results. The first troponin was negative, at less than 0.006, but the second one came back positive. It was 0.094. And that triggered both the consult and high dose anticoagulation. So, not surprisingly, the surgeons were kind of hesitant to take her to the operating room. Meanwhile, though, the abscess was beginning to threaten her neck. This was a false positive and she had not had an acute coronary event. The downstream consequences of that false positive included a 24-hour delay of surgery. So you asked me earlier what I learned in medical school about pathology and lab medicine. In med school, they made absolutely sure I could look through the microscope and recognize a myocardial infarction. However, the information about troponin came to me from one person or another, and almost never from a laboratorian. And I'll tell you what—in 20 years of internal medicine practice, I have never once been called on to do a heart biopsy and to look at the histology to determine if

the person was having an MI. But I need to interpret a troponin assay a dozen times a day, every single day that I'm working in the hospital.

[Dr. Laposata] I have something to say about the educational problem. It's clear we need to make sure that as future doctors learn pathology in medical school they learn clinical path as well as anatomic. This'll take some work, but I can say that at Vanderbilt our medical students will have a formal course in diagnostics, that's predominantly laboratory medicine, at the beginning of their first clinical year. This'll be a required course, with an exam, taught by laboratory experts. So this looks like progress. We don't expect primary care docs to look through the microscope and recognize cancer cells or look at an MRI and identify a suspicious mass. On the other hand, unfair as it is for them, based upon the discussion we're having now, we do expect them to pick the right lab test and interpret the result for it correctly, without help, every time. At Vanderbilt we have a regular meeting daily in multiple specialty areas of lab medicine, which are like anatomic pathology diagnostic sessions except no microscope. This is a great clinical and teaching tool, and it allows everyone interested in the clinical lab to get case experience in real time and contribute to the care of patients. We call this innovation - the Diagnostic Management Team. Can I take a minute to describe it?

[Dr. Meisel] It's a Diagnostic Management Team, you said?

[Dr. Laposata] This is a team of diagnostic experts who meet daily, and the goal is to provide a patient-specific expert-driven interpretative report, just like in anatomic path and radiology. So let me show you how it works for the coagulation team as an example. So, every day at 8:00 AM, a path resident or a fellow on the coagulation service at Vanderbilt—but this could be any laboratorian who's sufficiently knowledgeable—connects with the technologists in the special coagulation laboratory about the evaluations in progress. This person reads the clinical record and reviews the lab data for each case, and at 4:00 in the afternoon provides a tentative narrative interpretation of the test results. The final report is generated in a rounds format with the lab director. In these rounds, we can explain all of the data, including the pharmacogenomics, from the clinical lab in an interpretation that anyone caring for the patient, including the nursing staff, would understand and react to appropriately. I'm delighted that the leadership at Vanderbilt realizes the value of an expert laboratorian. They recognize that the institution can save thousands of dollars in a patient encounter if the laboratorian makes a quick and accurate diagnosis involving lab tests.

[Dr. Meisel] You know, obviously, I think at this point, having an interpretive lab service run by a knowledgeable person would be a huge help. But thing are getting more and more challenging for us both primary care and in the hospital. And I do think this would be one way of improving patient care. And, you know, frankly, actually making our lives a little bit better, as well. Hey, you know, could changing the whole focus of the expert laboratorian—really, the whole laboratory staff—to providing clinical support for people like me change the whole way the clinical lab is perceived and rewarded?

[Dr. Laposata] Yeah, huge—very insightful. I'd say that's a major message. So for more than a decade I've been advocating for a change in the center of gravity for the expert laboratorian, moving into the diagnostic management of cases.

[Dr. Meisel] Yep. So I've heard that some people actually challenge the notion that, um, helping doctors with test selection a-and results interpretation can make a difference in…in patient outcomes. Are there really diagnostic errors that matter when the wrong tests are selected, or is the error just that we ordered an extra triglyceride and it cost an extra fifty cents, didn't take much time, and frankly it didn't even cost that much?

[Dr. Laposata] I think you know the answer to that. So, it's a huge problem. The clinical consequences can be great. There's a society now that's focused on diagnostic areas of medicine. Within that society is a group that deals with diagnostic errors in test selection and result interpretation. There's a real science now in the analysis of diagnostic errors. Only in the last decade have papers begun to emerge showing that poor patient outcomes, up to and including death, are associated with the failure to select the correct tests or with the misinterpretation of the test results.

[Dr. Meisel] You know, it's even more than that. So here's another issue, one that comes up every time I attend on the inpatient wards—the follow-up of test results. Say, protein electrophoresis or a send-out, usually ordered by the medical resident, which come back after the patient's gone home or I've gone off service. So I'm legally responsible for those test results, but there's no good system in place to ensure I see them.

[Dr. Laposata] Yeah, so as I'm hearing what you're telling me about the cases, I think the most powerful statement to make is that it's a big problem right at this moment. We're talking about very common issues here—deep vein thrombosis, osteoporosis, myocardial infarction, a breach in the total testing process when a patient's discharged. Look, I understand how full your plate is. I understand practicing physicians are forced to rely on the less informative lab tests because they've used them for a long time, they don't have time to take the necessary steps to improve the accuracy of their diagnoses with newer tests, especially those molecular ones, which appeared in the last decade. It just seems only fair to the patient that if a test were readily available in the clinical lab to help the doctor understand precisely what the patient has, that's the test that should be used. So here are the issues I heard us talk about, that are also the targets of the CDC CLIHC™ committee. There it is. First, there's a great variability in how clinicians use the clinical lab, and for sure most of them would benefit from help in selecting the tests and interpreting the results, even if they don't know that. Second, the confusing nomenclature and the vast number of tests present a huge problem for clinicians trying to accurately and efficiently establish a diagnosis. Third, experts in the clinical lab want to help clinicians interpret the results they're getting. Fourth, sometime very soon medical student educators need to increase the teaching of lab medicine, because all med school graduates need to show competency at using lab tests to make a diagnosis. Fifth, expansion of operations like diagnostic management teams could greatly increase that communication between the expert laboratorian and the physicians in all specialties because it's a mechanism by which the clinician and the lab expert can work together on cases in real time, when treatment decisions are being made. And sixth, the prevalence of diagnostic errors in lab medicine is increasing rapidly, often with alarming consequences.

[Dr. Meisel] That's a pretty good summary. You know, my overall message is that the clinical laboratory has tremendous resources. And, you know, most important are the people in the laboratory who are the holders of that knowledge which I need to care for my patients. But we need to figure out a way that people can share that knowledge so I can use it in a clinically

meaningful way. So, none of us in medicine want to miss a simple solution to a diagnostic problem, one that could be simply solved by simply ordering and correctly interpreting the right laboratory test. Poor patient outcomes are far less likely to happen if we can work together effectively. And when I start on the ward at 7:00 Monday morning at Boston University Medical Center, a big part of my job description is catching bullets out of the air, and I need the help right now. I fully agree that we are in this together, clinicians and laboratorians.

[Dr. Laposata] All right, Jim. We want to make a difference for your patients.

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